Narration: In this presentation you will learn about USAID’s Forest Carbon Calculator, the purposes and scope of the tool, how it works and the underlying data.
Narration: Throughout the world, USAID land use and land management activities are having direct, significant and positive impacts on the climate. USAID’s forestry-related programs in more than 25 countries help to mitigate climate change by increasing removals or decreasing emissions of carbon dioxide. The impacts of these activities are real, but until now projects have not had the ability or tools that are necessary to translate these impacts into reportable, quantitative measures of carbon benefits.

The calculator was linked to the GCC Online reporting tool last Fall to help Missions calculate their CO2 indicator results. We are keeping it separate from the Online Reporting because we expect that at some point GCC reporting will become fully integrated into USAID’s larger reporting system. Once that happens, we will still need tools like this that are very technical in nature to help us calculate the indicator targets and results that will be entered into the USAID reporting systems.
**Narration:** In deciding which tools to develop, USAID’s portfolio of existing forestry-based projects are grouped into the following categories:

- **Forest protection** includes any activities that protect and conserve native forest against pressure from forest clearing, fire, and illegal logging.
- **Forest management** deals with activities that are designed to change technical forestry principles to manage and maintain a forest for timber production while maintaining the forest’s productive and renewal capacities, so the two activities that are included are reduced impact logging and stop logging.
- **Afforestation and reforestation** activities plant trees on land that is not currently forested and.
- **Agroforestry** activities are those activities that establish or manage trees within agricultural systems.

Forest policy activities that will ultimately result in an improvement in the way forests are managed and harvested are also grouped if a forest policy had an on-the-ground impact, then the four activities covered in this tool would allow estimation of the impact. If there was no immediate on-the-ground impact, then a carbon dioxide indicator is inappropriate.
Understanding ‘Admin Units’

- Calculators were designed to function at a sub-national scale (state, province, district, etc.)
- Each admin unit has a unique profile: default values in the calculator are based on local ecosystem properties
- If a project spans across a large region, user can select multiple administrative units
- Default values do NOT represent values for a given point on the landscape; averaged across the administrative unit

Narration: In order to cover all geographic regions where USAID works, a set of geographically explicit default values to calculate carbon dioxide emissions reduced or sequestered were created. For accuracy, the calculations recognise differences within a country, but for practicality, average values for regions within a country were created for subnational level of states, provinces or districts. Each administrative unit has a unique, location-specific value for key variables. If a project crosses multiple administrative units, the user can select multiple units. While these numbers represent an average value for the administrative unit, you as the user have the ability to override that value if you have a more accurate, site-specific value.
Narration: The calculator has a very easy graphical interface for choosing the geographic location of your site. First choose the region of the world, then the country and then the administrative unit. You can add multiple units into one project, even if they are in different regions of the world.
Two-Level Approach:

- **Level A**: minimal data input required
  - Area of project
  - Management effectiveness (0-100%)

- **Level B**: user can enter project-specific information if known
  - Baseline deforestation rate
  - Forest carbon or biomass stock
  - Volume of timber extracted
  - Carbon or biomass accumulation rate
  - Etc.

**Narration:** The calculator has two levels of accuracy and user input required. Level A simply requires the user to enter the area or size of the project, as well as a measure of the effectiveness of the project. If you want to enter project-specific data to override the default values, you select Level B and make changes.
In order to fill out Level A of the tool, you need to know how their activity can be expressed in terms of the calculator components. For example, if it is a community forest management activity, you need to know the number of hectares of existing natural forest that are being protected from deforestation or fires because of the project. These hectares would be entered in the Forest Protection calculator. If the communities are also allowing areas to regenerate forest cover naturally, or are replanting them, then those hectares should be entered into the Afforestation/Reforestation calculator.

While splitting up the hectares in this way may require some additional effort, it is necessary. The underlying equations and the carbon impacts are completely different. Undertaking this exercise is a good way to get the project implementers and USAID thinking in terms of carbon and better prepared for the much more complex task of obtaining carbon financing if desired.
Level A: % Effectiveness Rating

- Included to reflect project maturity
- Early phase projects may not be 100% effective yet
- Scale from 0% to 100% - user must choose rating
- Guidance is given in the calculators for selecting a value

Narration: USAID projects have different levels of effectiveness in improving the management of a forest area or reforesting a new area.

The project may just be starting, or it may be experiencing difficulties. The Effectiveness ratings provide a way to capture that and thereby increase the accuracy of the calculation. For each calculator, guidance is provided on how to assess the effectiveness of that type of activity and to translate it into a percent rating. We are still working on these effectiveness measures and future versions of the tool may have slightly different measures of effectiveness.
Narration: This calculator has four steps.
Narration: This is the login page. It contains a description of the calculators and links to download detailed documentation on the data and equations used by the tool.

Users need to self-register on the site. We do this so that we can store your data for one year, and provide it to you the next year to help you save time. This also allows us to create summary reports of the carbon savings that result from all USAID projects.
Narration: Once you have logged in you will see the first step which is to enter a project ID and a brief description and then choose a fiscal year. We are currently evaluating this section and may change the tool to automatically assign a project ID. Stay tuned for changes.

Once you have created a project ID, you have to select the project location by choosing administrative unit or units. When you choose a unit it is added to your “shopping cart”.
Narration: You can select an administrative unit by entering the latitude and longitude coordinates of a point within the project area.
Narration: The software will then automatically choose the corresponding administrative unit and add it to the shopping cart.
**Narration:** Another way to choose the right administrative unit is to select it using three drop-down lists. First choose the region, then the country and finally the administrative unit.
**Narration:** The administrative unit is now in the shopping cart along with the other unit you had chosen before.
Narration: The third way to choose a location is by maps. You can drill down by level of detail until you see the administrative units of the country. Click on the map to choose one or more units and they are added to the shopping cart. When you add an administrative unit it is displayed on the map in darker yellow.
Narration: You can go back up one level if you wish to see a different country.
Narration: You can also use the mouse, just as you can in Google maps, to pan across the content and see other parts of the map.
Narration: You can click on 'Up one level' to see the whole world and choose other locations.
Narration: Next you choose the calculators.
**Narration:** The calculator page displays all the administrative units you have chosen and next to each unit are boxes where you can choose one or more calculators for that area. If you need to delete an area, you can.
**Narration:** If you need help choosing a calculator, there is a ‘Help me decide’ tool which leads you through a series of questions.
Narration: For example, it asks: “Will your project reduce the incidence of illegal logging?”
Narration: After answering the questions you get a series of eligible tools.
Narration: After you have selected the calculators for each area, move on to the data entry page.
**Narration:** If you accidently did not choose a calculator for an area, the software will not let you proceed until you choose one or until you delete that area.
**Narration:** The data entry page once again displays each administrative unit along with the calculator or calculators chosen for each. In Level A you enter the number of hectares for that calculator and choose your preferred units.
Narration: You can click on the little arrows to expand the box and reveal the Level B option. This displays the default values used for that calculator and gives the user the option to change them.
Narration: As explained earlier, both Level A and Level B require rating the project effectiveness.
Narration: If you click on ‘What’s this’, you’ll see a description of how to do the effectiveness rating for that tool – in this case forest protection.
Narration: After you have entered all your data, you click ‘Submit calculator data’ and it will show you the results.
Narration: At the top of the screen will be a summary box that shows totals of carbon dioxide emissions reduced and sequestered for each type of activity and for each administrative unit, as well as a grand total.
Narration: The bottom of the screen shows the data used for all the calculators broken down by administrative unit. You can save or print this page for your records and to share with others.
Narration: At this point, you can go back to the beginning if you wish to enter another project.
Narration: You can also modify the data and recalculate the results.
How are Benefits Calculated?

<table>
<thead>
<tr>
<th></th>
<th>Forest Protection (t CO₂e)</th>
<th>Forest Management (t CO₂e)</th>
<th>A/R (t CO₂e)</th>
<th>Agroforestry (t CO₂e)</th>
<th>Total CO₂ benefits (t CO₂e)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admin Unit 1</td>
<td>4,598</td>
<td>3,388</td>
<td>8,825</td>
<td>4,940</td>
<td>21,751</td>
</tr>
<tr>
<td>Admin Unit 2</td>
<td>3,584</td>
<td></td>
<td></td>
<td></td>
<td>3,584</td>
</tr>
<tr>
<td>Admin Unit 3</td>
<td></td>
<td></td>
<td>4,857</td>
<td></td>
<td>4,857</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>8,182</strong></td>
<td><strong>3,388</strong></td>
<td><strong>13,682</strong></td>
<td><strong>4,940</strong></td>
<td><strong>30,192</strong></td>
</tr>
</tbody>
</table>

Narration: So how are these results calculated? Let’s look at the underlying data and equations. There is much more detailed documentation on the website.
Narration: The forest protection calculator estimates the carbon benefits by comparing the historical rate of deforestation for an area with the rate of deforestation under the project, which is zero if the project is 100% effective. To calculate the historical deforestation rate, you compare land cover between two years.

We found high resolution analyses based on Landsat data for Brazil, Guatemala, Indonesia, Liberia, Madagascar and Paraguay. For the rest of the countries, we used lower resolution MODIS satellite data to show deforestation between 2001 and 2004.

If the map shows the deforestation rate as the percent of the total forest in the country lost each year, and a country has a very low existing forest cover, then removal of just a small amount of forest results in a high percentage lost. This is why the Sahel is shown as having high deforestation. However, a map which showed absolute values of deforestation would show very high amount of deforestation in the Amazon and Indonesia.
Narration: The other aspect of calculating emissions reductions from forest protection is the amount of carbon currently in the forests per hectare. This map shows the many sources of data compiled into our global database.

Winrock has just received funding from the World Bank to do a globally consistent analysis of live tree biomass and forest soil carbon which will be included in this tool once it is available in December.
Narration: This map shows the biomass in tonnes per hectare. The Amazon and Congo regions and Indonesia have the highest amounts of carbon stored in their natural forests. These numbers are just for aboveground live tree biomass, but soil carbon is currently being added to the database. Dead wood carbon is not included.
Narration: As mentioned earlier, if the user has more accurate site-specific numbers for deforestation rate or carbon biomass they can enter them instead under Level B.
*Narration:* Forest management leads to decreases in carbon stocks in live biomass as trees are removed and killed or damaged as byproducts of the logging process. Creation of roads, skid trails, and log storage decks kills and damages trees. The logging activity results in increased carbon in dead wood and in forest products which decay over time, releasing emissions. The Forest Management calculator models this process.

The model assumes that a percent of harvested wood is used to make durable wood products such as furniture or houses, which are assumed to be retired from use and converted to CO2 emissions at a certain percent per year.

A series of field experiments in Indonesia, Brazil, and Congo funded by USAID calculated the average ratio of damage to neighbouring trees per unit of volume of tree extracted. These damaged trees are now dead and they release CO2 through decomposition at a particular rate.

In order to populate our database with default values for administrative units, we used FAO data and hired regional experts to collect data for USAID countries on the average volume of timber removed per hectare, average road width, average skid trail dimensions, and average size of logging deck where trees are stored before loading into the truck, boat, or river.

The default values are then entered in the emissions equations to calculate an emissions rate for standard logging practices in that administrative unit or location. Emissions reductions of project intervention are calculated by comparison to this standard rate. The intervention of stopping logging results in zero emissions, whereas reduced impact logging reduces the emissions by reducing the amount of damaged trees, and the sizes of roads, skid trails, and landing decks.
Narration: This screen shows that in Level B you choose either 'Reduced impact logging' or 'Stop logging' for that area. For reduced impact logging, the assumption is that the same volume of timber is removed, but for stop logging you would need to enter zero for volume removed after activity.

The defaults for volume extracted are derived from consultant reports and/or FAO/FRA (2000) data on harvesting intensity (m³/ha). Data derived from consultant reports gives the mean annual harvest area of concessions. If the project area is more than 1.5 times this mean annual harvest area, the tool defaults to using the mean annual harvest area. All WP are sawnwood and ten years of retirement and decomposition are included in the calculations.
Narration: The Afforestation/Reforestation calculator estimates the amount of new growth each year in tree biomass and then converts that into the amount of carbon dioxide sequestered in the trees. It uses default values of biomass accumulation based on ecological zones and by species within those zones. Average growth biomass accumulation for each administrative area was calculated by including only the biomass accumulation rates from those geographic areas which are currently unforested, and so could be reforested.
Narration: At Level B, the user can specify the type of species being planted or regrowing. The Intergovernmental Panel on Climate Change maintains a database that includes values for planted teak, eucalyptus, acacia, pine and natural regenerating native species within each ecozone.

Winrock is working on adding other species and ecosystems, such as bamboo and mangrove, respectively, as well as catch-all categories for other conifer and other broadleaf.
Agroforestry

- Reviewed the literature to create database with >200 entries
- Range of ages (2-30 yrs) and carbon values (2-105 t C/ha) included
- Data from all continents
- Growth models fit to data
  - Dry and wet climates
  - High, medium and low carbon potential

Narration: Agroforestry systems are very diverse, so creating default values required analysing existing data to look for patterns that could be used to categorise agroforestry into a more limited number of groups. More than 200 published research results were collected that gave a range of stand ages and carbon biomass levels.

Winrock used growth models to summarise the data into categories based on climate and on carbon potential of different types of agroforestry systems.
Narration: This graph shows the data points of the 200 research results and the modeled growth curves which categorize the systems. The green lines are systems in wet climates, which tend to have higher growth rates and total carbon, while the yellow lines represent drier locations. Within each of those two climatic categories are three curves representing high, medium, and low carbon storage potential that is related to the species used, density of planting, etc.
As explained previously, in addition to climate, which is determined by geographic location, the type and design of the agroforestry system affects its ability to store carbon. Examining across the vast diversity of agroforestry systems it was clear that the carbon potential can best be characterised by the speed of growth, the density of trees, and the quality of the site, such as the soils.

At Level A, the calculator determines if it is a dry or wet location by the administrative unit where the agroforestry activity is happening. It assumes that the agroforestry system is characterised by a growth habit of medium speed, tree density that is medium, and a site that has poor quality.

At Level B, you can change these defaults to take into account a more detailed understanding of your particular agroforestry system.
Next Steps

- Improve user interface
- Refine default databases
- User testing!
- Possible scenario planning and target setting component

Go to:
http://winrock.stage.datarg.net

**Narration:** This tool is still in development. Currently the tool only calculates carbon numbers over one year for the purpose of reporting estimated impacts. In the future we hope to add a planning tool that will provide multiple year projections of carbon benefits, helping you to set indicator targets and design programs. The planning component would also make it easy to manipulate the variables and compare options to see what types of project activities will generate the biggest benefits in terms of reducing emissions and increasing sequestration through your forest sector activities.

We are continuing to refine the user interface and the default databases in response to USAID user and expert reviewer comments.
Group Exercise

☐ Try it out!

Go to:
http://winrock.stage.datarg.net
Discussion

- List out the specific forest sector activities your mission currently supports.
- Are those activities currently resulting in on-the-ground impacts of reduced emissions or increased sequestration?
- What are the indicators being collected now? How would they need to change to be useable in this calculator?
- What capacity building will be required with your partners and clients to enable them to set carbon targets and use this calculator?
- What type of field support or training is needed to roll out carbon indicators in your programs?
- Taking all this in mind, what additional functions and improvements should we add to the calculator?
- How should we promote it and train on its use?